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A LECTURE

ON

THE HUMAN BODY.

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THE HUMAN BODY.

The subject of this lecture is the human body. Against this subject there will doubtless be a prejudice in the minds of many of my hearers, because it is not delivered by a physician. I will not undertake to deny that there are grounds for this prejudice. If I had spent a number of years in studying the human frame under able professors, and had put my knowledge in practice in after years, I would, of course, be more competent to lecture on the subject than I can be now.

On the other hand, my acquaintance with the living body, though very limited, is more than it would have been had not a failure of my health induced me to investigate its cause and seek the remedy.

This, I hope, will be a sufficient excuse for stating a little personal experience.

When I was in charge of a few small missionary stations in the western part of New Jersey, I at first occupied a large room on the second floor of an ill-built house, in an exposed situation. The sashes on the opposite sides of the room were so loose that the wind blew through them with little hindrance, and, in winter time,

even with a large fire, I could not always keep comfortable. If any one conjectures that this exposure was the cause of my sickness he will be much mistaken, for I never enjoyed better health.

What then was the cause of my disease?

It was occasioned by a change of residence.

I left my cold room for a warmer room in a better house. My new apartment was much smaller and tighter than my previous one. It had but one window, which could neither be pushed up nor pulled down, and of course it could be ventilated only by the entry. In this close apartment, which in the winter was heated by an air-tight sheet-iron stove, I slept at night and studied by day. This almost constant occupation of a small, ill-ventilated, over-heated room, combined with too little work for the muscles, and too much work for the brain, soon undermined my health.

I could not study to advantage: I gradually lost flesh, and strength, and color, and appetite.

Nor was this all. I soon obtained a cough. The first and the second attacks of this cold, as it is popularly termed, though in my case it did not arise from exposure, were driven away by appropriate treatment, but not the third.

It hung on me for months and would not go away. In the spring I was so reduced, that a short walk at a slow pace would tire me, and I shivered under an overcoat in the mildest weather.

I was obliged to leave my station and go home. Then I consulted a distinguished physician, who, after sounding my chest, told a relation of mine that I had the consumption, and would never preach again.

Although this opinion was kept from me, I knew that my case was well nigh hopeless, for both my mother and one of my brothers died of consumption, and neither of them, when first subjected to medicinal treatment, was so weak as I was then. It was this which induced me to read a few popular works on the human frame, one of which was written by Dr. Andrew Combe, formerly royal consulting physician, in England.

The last named work was the more suited to my case since the doctor had inherited a consumptive tendency from his parents, and had preserved his life with the greatest care.

The conclusion to which I came, from the slight knowledge of my system thus acquired, was this: that in order to regain my health I must exercise my brain less and my muscles more, that I must eat simple food and drink pure water or milk, and that I must take a daily bath, and breathe pure air as much as possible. Accordingly I put these things in action. I ventilated my sleeping room during the day, and kept the window partly open in the night, and spent most of the day in the open air.

At first I was so weak, that I was obliged at frequent intervals to sit down on the wayside and rest, before I could resume my slow and tottering walk.

By this means, however, since the season was favorable, I was enabled to spend almost the whole day in the open air.

This course of treatment I pursued for months, and gradually regained my health.

It was a long time before I got rid of my cough, even after I had gained an appetite and was improving in flesh and color, but at length it left me.

The result was that I, who had panted after walking a few rods, and had shivered in the mild breath of spring, could now run up and down the mountains and endure more cold than most.

Hoping, my hearers, that you will excuse this personal narration in consideration of the object, permit me to remark, that my knowledge of the human frame then began, I have since extended, although I am aware that it is very limited. You will not, of course, expect me to treat of every part of the body in one lecture, nor would it be possible. It is my design to treat only of some of its most important organs.

If I shall succeed in giving my hearers a clear conception of these, then my object will be accomplished.

I intend to treat of the blood vessels, of the organs that purify the blood, and of those which convert the food into blood.

And first of the blood vessels. The blood vessels are the heart, the arteries, the capillaries and the veins. The heart is a hollow muscle lying in the chest, partly to the left, between the two lungs. The muscles form the lean flesh and are the instruments of power, causing, by their contractions, every motion of the body. The heart is divided into two cavities, one on the right and the other on the left, which have no direct communication with each other. These cavities themselves are divided each into two chambers, which are called the right auricle, and the right ventricle, and the left auricle, and the left ventricle. The right auricle opens into the right ventricle, and the left auricle opens into the left ventricle. From the right ventricle goes a large tube called the pulmonary artery, which separates into two branches,

one leading to the right lung and the other to the left.

These branches divide and subdivide into almost countless tubes, until they are brought into contact with all the air-cells of both lungs. Having done this they unite into larger tubes called pulmonary veins, and these again into larger, until forming four great veins, two from each lung, they communicate with the left auricle.

This cavity opens into the left ventricle.

From this chamber arises the main artery of the body, called the aorta. This divides and subdivides into smaller and still smaller arteries, which are distributed throughout the body. From these extend the capillary vessels, which are many times thinner than the finest hairs, and form a network through the whole structure of the body, impermeating every organ, every muscle, every bone. They even penetrate the nails, and the whole length of every hair. These capillaries communicate with the veins which run in an opposite direction to the arteries. These veins unite into larger ones, and these into still larger, until they form two great veins, one of which opens into the right auricle from above, and the other into the same cavity from beneath. Such is the structure of the heart, the arteries, the capillaries, and the veins. What now causes the blood to circulate through these vessels?

It is caused in part by the alternate contraction and relaxation of the four cavities of the heart. The openings that lead into these cavities, and out of them, are guarded by valves that permit the blood to pass through them on its way from the veins to the arteries, but prevent its return. The auricles contract when the ven-

tricles relax, and the ventricles contract when the auricles relax. Thus the auricles force the blood into the ventricles at the very time that the ventricles are empty and ready to receive it.

Having thus seen how the ventricles receive their blood, let us now inquire how the auricles become filled with blood.

It is done in this way. When the auricles relax, they are, of course, enlarged, and thus are partially empty.

Into the vacuum thus formed in the right auricle the blood is forced from the veins of the body by the pressure of the air. The same cause also drives the blood of the pulmonary veins into the left auricle. The right auricle, when filled with blood, contracts and forces it into the right ventricle. The right ventricle, in its turn, contracts and drives the blood among the pulmonary arteries. The left auricle being filled with blood at the same time with the right auricle, also contracts and forces it into the left ventricle.

The left ventricle in its turn contracts and drives the blood into the main artery and its branches. The arteries contract behind the blood and force it into the capillaries. Through the capillaries the blood is urged by nervous influence into the veins. It is driven along the veins partly by a little contraction of their coats, but mainly by the pressure of the air which forces it into the right auricle every time it relaxes. In order to prevent the blood from flowing backward in the veins when the right auricle is contracting, they are provided with valves that allow the blood to pass onward but prevent its return. The blood easily circulates through the pulmonary arteries and veins, since it is

forced into the pulmonary arteries by the contraction of the right ventricle, and it is driven from the pulmonary veins into the left auricle by the pressure of the air.

Thus the blood is drawn from every part of the body to the right side of the heart, and sent thence to the lungs, and it is drawn from the lungs to the left side of the heart, whence it is distributed to every part of the body.

I have stated that the blood vessels are distributed among the lungs. These organs therefore now present themselves for our consideration.

The lungs, two in number, are placed in the chest, the one on the right side of the heart, and the other on the left. They are composed of six hundred millions of little air-cells. These are grouped together in sponge-like masses, and every mass is united to a small tube which opens into every cell. These tubes communicate with a smaller number of larger tubes, and these with others still fewer and larger in number, until they unite into two great tubes, one of which comes from the right lung and the other from the left. These are the bronchial tubes, and they unite in the windpipe, which communicates with the outer air by the nostrils and the mouth. Such is the structure of the lungs.

And now for the manner of breathing.

Before explaining this process we must look at the formation of the chest. The chest is the large cavity in the upper part of the trunk. The walls of the chest are supported by the ribs. The ribs are the semicircular flat bones, twelve on each side of the body, that curve around within the chest. All except the four lowest

are fastened to the breast-bone in front, with an elastic substance called cartilage.

All are attached to the spine behind by hinge joints, and thus can be moved upward and downward.

The ribs are lower before than behind, and curve downward at the sides. Now, since the ribs are lower before than behind, you will perceive that when they are raised the breast-bone is thrust outward, and the chest is enlarged in front.

For the same reason, when the ribs are lowered, the breast-bone is forced inward and the chest is diminished in front.

Again, since the ribs curve downward at the sides when their middle parts are raised, the chest will be enlarged from side to side, and when they are lowered the chest will be diminished from side to side.

The principal muscles that promote breathing are the diaphram, the abdominal muscles, and the muscles between the ribs.

The diaphram fills the bottom of the chest and is fastened to the lowest ribs.

The abdominal muscles are placed in the lower part of the trunk beneath the diaphram, from which they are separated by the liver and other organs, and they are fastened by tendons to the ribs. The muscles between the ribs pass crosswise from rib to rib on both sides of the body. When we are about to draw in the breath the diaphram contracts downward, and swelling in the middle, presses the ribs out, and the muscles between the ribs contracting from above, raise the middle of every rib.

The chest is thus enlarged beneath, in front, and on both sides, and the air in the lungs, which are never

entirely empty, expanding with the chest, becomes rarified, and cannot resist the pressure of the outer air which rushes in and fills the lungs. Thus we breathe in.

What now takes place when we are about to breathe out? The abdominal muscles contracting pull the ribs downward and inward, and enlarging in the middle press the liver and other organs against the diaphram, and force it up into the chest, and the muscles between the ribs contracting from beneath pull down the middle of every rib. The chest is thus diminished beneath, in front, and on both sides, and compresses the lungs and forces the air out. Thus breathing is like blowing a bellows.

The alternate enlargement and diminution of the chest in breathing, must modify to some extent the circulation of the blood. When the chest is enlarged, the chambers of the heart are also enlarged, and hence will receive and discharge more blood. When the chest is diminished the chambers of the heart are also diminished, and hence will receive and discharge less blood. Thus, at the very time that the lungs are filled with air, more blood is sent among them, and less blood when they are partially empty. I have before stated that it is the contraction of the left ventricle which drives the blood into the arteries.

This begets an impulse that is felt to the extremities of the body, and is called a pulsation, and by repetition forms the pulse.

There are two pulsations every time we breathe in, and two every time we breathe out.

Thus there are four pulsations for every respiration. Hence, if we wish to ascertain the state of an invalid's

pulse without disturbing him, we have only to count the number of times he breathes and multiply it by four.

In the vigor of life we breathe, on an average, eighteen times a minute, and have seventy-two pulsations.

In infancy it is more, but in old age it is less.

We thus perceive that there is a regular proportion between the quantities of air and of blood that are sent to the lungs. It is computed that, on an average, a pint of air enters the lungs at every inspiration, and that one-eighth of a pint of blood is distributed among them at every pulsation. Since, then, there are four pulsations for every respiration, four-eighths or one-half of a pint of blood is sent to the lungs for every pint of air. This in twenty-four hours amounts to 25,920 pints of air, and 12,960 pints of blood, which is equivalent to sixty hogsheads of air and thirty hogsheads of blood.

It may be asked how so great a quantity of blood can be sent to the lungs when there are only about one hundred pints in the body.

It is done by continual circulation, the same blood, though in a changing state, returning often to the lungs. The blood makes the entire circuit of the body in six minutes, and this is repeated two hundred and forty times in twenty-four hours.

We have seen, my hearers, that a pint of air enters the lungs at every inspiration, and that one-eighth of a pint of blood is sent among them at every pulsation.

You will naturally inquire, how is it that such quantities of blood and of air can exert much influence over each other during the short time they are together; for we no sooner breathe in the air than we breathe it out

again, and the blood travels four times as quick as the air. It is done in this way.

The air on entering the lungs is distributed among six hundred millions of air-cells, and the blood is still more minutely divided, for the capillaries in which it is contained form a network over every one of these cells.

Thus the air and the blood, being subdivided among each other in quantities too small for human conception, work great changes in each other during little time.

These statements may give some idea of the importance attached by the Creator to the purification of the blood. But this conception will be increased if we consider the extent of surface over which the air and the blood are spread, when exposed to each other's influence during twenty-four hours. Every pint of air we breathe in is diffused over the whole surface of the lungs, which amounts to one hundred and fifty square feet.

It is easy to compute the space over which 25,920 pints are spread.

This amounts to 3,888,000 square feet, which exceeds the eighth of a square mile by 403,200 square feet. But we have seen that the blood is sent to the lungs four times as often as the air, and hence is spread over a surface four times as great.

This amounts to 15,552,000 square feet, which is the space occupied by 6,620 city lots, and exceeds the half of a square mile by 1,612,800 square feet.

So great are the surfaces over which such large quantities of air and of blood are brought into such intimate contact every day.

Now no one will suppose that the air and the blood are thus brought together for no purpose, and that on

leaving the lungs they are in the state as before. To this point I will now direct your attention. The cells of the lungs, and the coats of the pulmonary arteries, are composed of delicate transparent membranes, that permit the gases to pass through them but not the blood, and hence the latter can be changed by the action of the air without entering the cells of the lungs.

What is the nature of this change?

Oxygen passes from the air into the blood, and carbonic-acid gas passes from the blood into the air. What is oxygen, and what is carbonic-acid gas? Oxygen is a gas that has a great attraction for the elements of almost all substances, and hence readily combines with them. It forms, by weight, one-fifth of the air, eight-ninths of the ocean, nearly one half of the globe, and much more than half of the bodies of all plants and animals.

Without it we could not produce either light or heat. When wood, for example, is burning, the oxygen of the air combines with the charcoal of the wood, which is called carbon, giving out light and heat, and forming carbonic-acid gas.

Thus we see that carbonic-acid gas is a union of oxygen and charcoal. It has properties differing altogether from those both of the solid and gas which join to form it.

It is a poison, as is proved by the death of those who have remained a short time in a close room where charcoal was burning. It is from the accumulation of this gas in the blood, more even than the want of oxygen, which causes death in drowning.

Thus we see that the blood parts with a poisonous gas to the air, and takes from it a healthful element in

return, and thus from two causes the air is made impure while purifying the blood. But there are other impurities to be removed. These are dissolved in water, which, in the form of vapor, passes from the blood along the whole length of the tubes that branch among the lungs, and thus pass into the outer air. Thus, also, the air is made impure while purifying the blood.

In addition to the other benefits which the blood receives from the air, it obtains from it electricity. This is stored up by the nerves, which furnish it to the muscles and enable them to perform the functions of the body.

We have seen that the air of the lungs changes the nature of the blood. This change of nature is accompanied by a change of color. Before reaching the lungs the blood is of a dark-red color, but after passing from the lungs it is of a bright scarlet. It retains this color until it enters the capillaries, where it undergoes a change from bright scarlet to dark red, and in this condition enters the veins.

What causes this change from bright scarlet to dark red blood? The causes are twofold.

The oxygen of the blood unites with the tissues of the body, for which it has great attraction, and forms various compounds, but chiefly carbonic-acid gas.

Thus portions of the body are destroyed, but they are immediately replaced by new flesh formed from the blood.

The blood being thus deprived of its healthful elements, and filled with noxious ingredients, becomes again of a dark red color. We have seen that our own flesh is

constantly wasting away, and as constantly being renewed.

This pulling down and rebuilding of the body is constantly going on in every tissue, even in the solid bones, so that on an average we obtain an entirely new body every five years.

It proceeds faster in the young than in the old, and in the healthy than in the diseased. In youth the supply is greater than the waste, and hence at this period we grow larger. In manhood the supply and waste are equal, and hence our bodies then remain the same in size.

In old age the waste is greater than the supply, and hence at this period we gradually waste away until feeble nature cannot repair the crumbling body, which returns to the elements from which it was formed.

I have stated that the wasting away of the body in the capillaries takes away oxygen from the blood and fills it with carbonic-acid gas. The removal of this carbonic acid, and the restoration of oxygen is accomplished mainly by the lungs.

In performing this work, however, it is aided by the skin, which, over its whole surface, permits carbonic-acid gas to go out from the blood to the air, and oxygen to come in from the air to the blood.

Thus the skin breathes as well as the lungs, and poisons the air, and robs it of nutriment while purifying the blood.

But the skin serves a more important purpose even than that of breathing.

All over the surface of the body are little openings called pores. There are seven millions of tubes that pierce through the skin, and communicate each with a

little bag called a sweat gland. These glands are all surrounded with blood vessels.

What duty do these glands perform?

Before answering this question I must make a little explanation.

When the tissues of the body are disorganized by their union with oxygen, not only does carbonic-acid gas result, but certain other compounds of which nitrogen forms a part.

What is nitrogen?

It is a gas that has only a feeble attraction for a few elements, and hence makes but few combinations, and from these it is easily separated. It is for this reason that nitrogen plays an important part in those substances that are easily decomposed. It forms, by weight, nearly four-fifths of the air, and one-sixth of the muscles of the body, and is a constituent of the most important articles of food.

The compounds of nitrogen with other elements are dissolved in water. The water for this purpose is obtained partly from the liquids we drink, and partly from the union of oxygen and hydrogen which result from the decomposition of the tissues. Hydrogen is the lightest of gases, having about one-fourteenth the weight of common air. It forms one-ninth of the weight of water, and is an essential part of vegetables and animals. When oxygen and hydrogen combine to form water they give out great heat. Thus the temperature of the body is preserved as well as by the union of carbon and oxygen.

The water thus obtained dissolves the compounds of nitrogen, and oozes from the blood vessels into the sweat

glands, where, being converted into vapor by the heat of the body, it issues from the pores, and is called the insensible perspiration. Since the pores of the skin are seven millions in number, and are, on an average, a quarter of an inch long, their united length is 1,750,000 of inches. Now, since 63,360 inches make a mile, we find by division that the united length of the pores of the skin is nearly twenty-eight miles. I have stated that the conversion of the impure water of the blood into the vapor that issues from the pores of the skin, is due to the heat of the body. It hence follows, that when we perspire freely, much heat passes from us, and less heat when we perspire less. The sweat glands are thus the regulators of animal heat, and act much more freely in summer than in winter. On the contrary, the lungs act more freely in winter than in summer, for cold air, being more dense than warm air, will give more oxygen to the blood, and receive more carbonic-acid gas in return. Thus each is more active when the other is least so, and thus it was ordained, that in all seasons the blood might be purified and the health preserved.

The pores of the skin are liable to be closed by a thin glazing formed over their mouths. This glazing is caused by the hardening of some impurities that pass through them, and also by the old oil that is secreted from the blood for the purpose of rendering the skin flexible.

The removal of this glazing is one of the benefits which are derived from a daily bath. Those persons, therefore, who wash the entire body, pass off impurities much more freely from the skin than those who wash only the face and the hands. The insensible perspira-

tion passes, of course, into the air, and thus while the blood is rendered pure the air is made impure.

The amount of morbid matter that passes off from the healthy skin in twenty-four hours, is estimated at two pounds.

The amount of impure and poisonous matters that pass out of the blood through the skin and the lungs, is almost twice as much as are removed by the liver, the kidneys, and the large intestine combined.

Think of this fact, think of the vast volume of gaseous matters that are required to weigh two pounds, think of the sixty hogsheads of poisonous air and foul vapor that is discharged from the lungs, and then you may realize how much purer is the air of the heavens than the air of a house, and then you may feel the need of ventilation.

It is supposed by many that the draught up the chimney, making a vacuum in the room, and thus causing the pure air to rush in through the crevices of the door and windows, will furnish a sufficient ventilation. This might be the case in an ordinary apartment, were it not for the fact that the outer air being colder, and of course heavier than the air of the room, will fall to the floor as soon as it enters the room, and be drawn into the stove, and thus the fire will be fed with pure air, while we breathe the poisonous exhalations of our own lungs and skin.

How can this be remedied? In a very simple way. Let a hole about the width of a stove-pipe be made into the chimney from the upper part of the room. Then the upward draught of the chimney will draw away the foul air from the upper part of the room, and the pure

air from the windows and door will rise to supply its place.

To this it will be objected, that a hole in the upper part of the chimney does not look very ornamental.

This objection will be removed simply by driving two spikes in the wall beneath the hole and one above it, and by resting a picture, or engraving, on the lower spikes, and letting it hang over in front from a cord which is fastened to the upper spike. Thus the air can find ready entrance into the chimney behind the picture, while the appearance of the room, as well as the health of its inmates, will be improved. Of course, my hearers, much remains to be said respecting ventilation, but its further discussion would lead me away from my subject. Let us now proceed with the purification of the blood.

Among the organs which serve this purpose are the kidneys. The kidneys are two in number, and are situated in the large cavity beneath the chest, in the lower part of the trunk.

This large cavity is called the abdomen.

The kidneys are placed half way from the top to the bottom of the abdomen, one on each side of the spine. They are small bodies, and weigh each about four ounces.

The length of each kidney is twice its width, and its width is more than twice its thickness. Its shape is somewhat of a flattened oval. Its structure is dense, but it is easily torn apart.

Each kidney has an outer layer, and several internal bodies arising from that layer.

The outer layer is composed of small tubes and blood vessels, and a large number of little globules. Into

every one of these globules a tube enters, and is coiled about many times, and is interwoven with a network of blood vessels, and then passes out again. Such is the structure of the outer layer.

From the internal surface of this outer layer a number of pale red bodies, shaped like pyramids, project towards the centre of each kidney. The bases of these pyramids, resting upon the outer layer, touch each other, but their sides are apart, and hence, in the centre of each kidney, and between the adjoining pyramids, there is a hollow space. This hollow space communicates with a tube on the outside of the kidney which leads downward.

Let us now examine the structure of the pyramids. Each pyramid is composed of a number of straight tubes which run from its base to its point, and are continuations of the tubes of the outer layer. The spaces between these tubes are filled with a spongy pith. Such is the internal structure of these pyramids. Let us now look to their covering. The tubes of the outer layer pass not only to the inside of the pyramids but also to their outside. In doing so they are interwoven with blood vessels, and form a delicate covering to each pyramid from its base almost to its point.

Such is the structure of the kidneys.

And how do they act in purifying the blood? In this way. The dark red blood circulates through the blood vessels of which we have spoken, and certain impurities dissolved in water, ooze into the little tubes, and then pass into the hollow space of each kidney, and thence are conducted out of the system. What is the nature of the impurities thus removed? It is a substance composed mainly of carbon, oxygen, hydrogen,

nitrogen, and sulphur, for sulphur, as well as phosphorus, and other elements, form a part of the body and the blood.

It is by the kidneys that the salt and other mineral impurities of the blood are removed. The next purifier of the blood is the liver. The liver is the largest organ of the body, and has an average weight of four pounds. It is placed in the upper part of the abdomen, immediately beneath the diaphragm. It lies mainly on the right side of the body, though it extends to the left side beyond the centre of the body. Above, it bulges out, but it is scooped out beneath, and its edges are very thin. On the right side its middle part is very thick, but thence to the extreme left it diminishes in thickness like a wedge.

The liver is a gland. In its lower part there is the gall bladder, which is a pouch leading into the small intestine.

From the gall tube proceeds the main tube of the liver. It has branching tubes, and branches of branches, each ending in a cluster of little pouches.

The outside of every one of these pouches and tubes, and the outside of the gall bladder, is brought into contact with branching veins that bring back the dark red blood from the stomach, small intestine, and pancreas.

From the impure blood on the outside of the tubes, and pouches of the liver, bile is secreted and poured into the small intestine. From the impure blood on the outside of the gall bladder, gall is formed, and is also poured into the small intestine. And now what becomes of the gall and the bile? They pass along the folds of the small intestine, which is a tube very long and very narrow, until they reach the lower part of the

right side of the abdomen, where they pass through a valve into the large intestine. The large intestine is wider than the small intestine, but not so long, being about five feet in length. It rises for some distance in the abdomen, and curves around to the left, forming almost a complete circle before it leads out of the body.

It is composed of three coats, the outer being a thin shining membrane, which is pierced by numerous small tubes, each communicating with a little bag. These secrete from the blood a thin, watery fluid, for the purpose of making slippery the surface of the large intestine and protecting it from injury. The inner coat is also a delicate membrane, pierced with many small tubes, each opening into a little bag. These secrete from the blood a slimy fluid called mucus, which gives a smooth surface. Between these two membranes there is a coat of muscular fibres. Part of these run lengthwise and part run around the large intestine.

The circular fibres are much more numerous at frequent points along this organ, and hence give it the appearance of a series of pouches. The long fibres, by contracting, make the large intestine shorter, and the circular fibres, by contracting, make it narrower, and thus it is capable of a variety of motions. And now for the use of this organ. Its inner coat is pierced not only by the mucous tubes, of which we have spoken, but also by about ten millions of other little tubes communicating with small bags. These secrete from the blood its more solid impurities. As these impurities are poured into the large intestine, they are mingled with the gall and the bile received from the small intestine. When these materials have sufficiently accumulated, the mus-

cular fibres contract behind them and thus drive them out of the system.

Such are the organs that purify the blood.

The blood of the veins, being thus freed from most of its noxious ingredients, does not receive any further purification until it reaches the lungs.

But there is a portion of the impure blood of the capillaries which is separated from the rest, and is conveyed to the right side of the heart in different vessels from the veins.

The fluid thus separated from the blood looks something like water. It is called lymph, from lympha, a Latin term for water, and the vessels which convey it are called lymphatics. The lymphatic vessels begin in a network of delicate tubes which connect them with the capillaries. Hence they proceed in parallel tubes from almost every tissue of the body to the root of the neck, when they empty their contents into the veins. The lymphatics are provided with valves that allow the lymph to pass through them on its way from the capillaries to the heart, but prevent its return. In their course they are intercepted by many small egg-shaped bodies called glands.

Before entering these glands the lymphatic vessels divide into several smaller tubes, which enter the glands and form a network within them, and bend hither and thither so as to present much surface in little space. After going out of the glands these little tubes unite, and form larger tubes the same in number as before. These glands are fully supplied with nerves and blood vessels. The arteries and the organic nerves enter them, and branch, and bend hither and thither, and are

interwoven in every direction with the lymphatics. Thus in small quantities, over large surfaces, though in little space, the transparent lymph, and the thread-like nerves, and the scarlet blood, are brought into intimate contact, and exert great influence over each other in a short time.

What is the nature of this influence?

This is a subject surrounded with darkness. There is no doubt that the blood becomes noxious from contact with the lymphatics, and requires to be purified before it can enter the arteries. But what change does it exert upon the lymph?

We know that when a poisonous substance enters a lymphatic gland, the blood rapidly accumulates within it, forming an inflammation. This it does in order that either by nervous influence, or by parting with some of its own elements, or by removing some of the elements of the noxious compound, it may cause it to pass into new combinations and become harmless. Thus poison in the lymphatics is far less injurious than poison in the veins.

But I apprehend that the chief change which the blood makes in the lymph consists in a different arrangement of its ultimate elements. What do I mean by this?

I can best explain it by an illustration. Certain plants have the power of forming sugar in their tissues. Of what is sugar formed? It is composed of carbon, and oxygen, and hydrogen. Now oxygen and hydrogen both exist in sugar in the exact proportions in which they combine to form water. Thus sugar is formed by the union of charcoal and of the elements of water.

But can the chemist produce sugar out of charcoal and water?

No, it is not in his power, for sugar is the product of life. With the exception of the vital power residing in the bodies of animals, it is the only living plant drinking water from the ground, and from the air, and breathing in carbonic-acid gas, and breathing out oxygen, while retaining the carbon, that is able to combine carbon and the elements of water in such a way as to form sugar. But more than this. A grain of wheat contains a large proportion of starch but very little sugar. Let it, however, be planted in the earth, under the influence of air, and water, and light, and heat, and electricity, and it will germinate and convert its starch into sugar. Again, in the ripening of the grain the plant converts its sugar back to starch.

This it does not by the addition or subtraction of one or more elements, but by arranging them in a different way; for the chemist, on analyzing starch, finds it to consist of the same element as sugar, and in the same proportion. Now no one would suppose that substances possessing such different properties as sugar and starch, differed from each other only in a different arrangement of their ultimate elements, were he not told so by the chemist. Let us not then be surprised, when we are informed that the change which the blood makes in the lymph consists not so much in the addition or subtraction of elements as in their different arrangement. The lymph being thus changed and partially purified, is poured into the veins at the root of the neck, where it is mingled with the blood, which has also been partially purified by the organs we have mentioned.

Then the red blood and the clear lymph are sent to the lungs, whence, after parting with carbon and impure vapor, and receiving oxygen and electricity, they become scarlet, and are sent to every tissue of the body pregnant with the elements of destruction and restoration.

We have seen that the oxygen of the air enters the blood, combines with the tissues of the body, and forms noxious compounds which are removed from the system.

We have also seen that the wasted tissues are replaced by new flesh formed from the blood. Unless, then, new blood is made to counterbalance the loss of the old, we will gradually waste away and die of starvation. To prevent this result we have the organs of nutrition.

These are the teeth, the salivary glands, the stomach, the small intestine, the pancreas, and the chylous veins.

When the food enters the mouth, it is cut, and ground, and mashed by the teeth. Hence, if a person has no teeth, his food should be divided very minutely before it enters the mouth. The motion of the jaws in chewing, and the rolling of the food about the mouth by the tongue, excites the salivary glands to action.

What is a salivary gland? It is a tube, with branching tubes, and branches of branches, each ending in a little pouch. Between these pouches and tubes, there is soft cellular flesh, which is inclosed in a delicate membrane, making the whole the shape and size of a robin's egg.

The cellular flesh is impermeated in every direction with nerves and arteries, and thus the blood is brought into contact with the outside of every pouch and tube, and is thus spread over great surface in little space.

These glands are six in number, and are imbedded in the flesh, two before the ear, two under the jaw, and two under the tongue, and every one has a continuation of its main tube, that opens in the inside of the mouth.

The desire for food, and its presence in the mouth, causes a flow of nervous influence and blood to these glands.

From this blood saliva is made, and exudes into the pouches and tubes of the glands, and issues into the mouth. There it is mixed with the food, which is thus prepared for the action of the stomach.

In order to promote the flow of saliva, it is better to have our food in the solid than in the liquid form ; and for the same reason those who have no teeth should roll it about the mouth before swallowing it. Since the act of sucking promotes the secretion of saliva and mixes it with the milk, it is not proper to feed an infant with the spoon. From the fact that saliva is made from the blood, if the blood be pure the saliva also will be pure. Impure saliva, therefore, is a sign of unhealthy blood. The same statement may be made respecting the mucus.

The mucus is the slimy substance spread over the surface of the mouth and tongue in order to make a smooth passage for the food. It issues from little tubes that pierce the lining of the mouth and tongue, and communicate each with a little bag surrounded with blood vessels.

Since the mucus, like the saliva, is formed from the blood, its purity or impurity will also indicate a corresponding state of the blood. Hence the physician is often able to judge of the condition of the patient from the color of his tongue.

But to return to the process of nutrition.

The food having been chewed and mixed with saliva, is thrust by the tongue into the back-mouth. The back-mouth is a pouch of a funnel shape, and leads down to the windpipe and the gullet. The windpipe is in front of the gullet, and has a valve over its top which closes when the food approaches, and prevents its entrance. The back-mouth having received the food, contracts, and forces it over the closed valve of the windpipe down into the gullet.

The gullet is a tube that passes down through the chest and opens into the stomach. It is composed of muscular fibres. The upper fibres of the gullet contract upon the food within them, and force it down a little, and the fibres beneath them, contracting in succession, give to the food a continuous downward motion until it enters the stomach. The stomach is a large bag, capable, in a grown person, of holding about three pints. It is placed beneath the diaphragm, somewhat to the left, in the upper part of the abdomeen. Its right portion is beneath the left portion of the liver. The stomach has two openings, one on the left leading into it from the gullet, and another on the right leading out of it into the small intestine.

Around each opening there is a muscular ring, which, by contracting, closes the passage, and never relaxes except when something is either to be forced into the stomach or forced out it. The muscular ring on the right is called the pylorus, a Greek term for a door-keeper.

It is a little lower than the ring on the left, and the stomach hangs between them. The stomach is covered

with two coats of muscles, the one running lengthwise, and the other around it, and these, by contracting, diminish its size in every direction. Its inner lining, called the mucous membrane, is very thin, and is arranged in numerous folds, which greatly enlarge its surface. This is everywhere pierced by more than a million of small tubes, each having branches, and every branch a group of little bags.

In contact with these is a network of blood vessels, from which they obtain mucus to give a smooth surface for the rolling of the food. In addition to this, over the whole surface of the mucous membrane, little fibrils jut out like short threads, so many and so close as to resemble the delicate nap of velvet.

Within these fibrils there is a network of blood vessels, from which a fluid is secreted, clear as spring-water. This liquid is called the gastric juice, from gaster, a Greek term for the stomach.

The gastric juice converts the food within the stomach into a grayish fluid, sligthly sour, and slightly sweet.

This fluid is called chyme.

This change in the nature of our food is called its assimilation, which means the act of making one thing like another. Thus the conversion of food into chyme, is called its assimilation to chyme, and the successive changes which chyme undergoes before it is converted into the tissues of the body, are but successive assimilations. In fact, the sum of all the changes experienced by the food from the time it enters the stomach until it becomes flesh, is called its assimilation to flesh. Let us now see the mode in which the food is submitted to the action of the gastric juice.

There is a contraction of the stomach about one-third of its length from the right extremity. The portion on the left of this contraction is several times larger than the portion on the right. It is only in the left portion that the unassimilated food is contained.

There it is arranged in a globular mass, the outer layer consisting of the food first eaten, and the next layer of the food next eaten, and so on to the centre, which consists of the food eaten last.

When the food has been thus arranged, the capillary vessels within the fibrils become loaded with blood, and from it the gastric juice is secreted and poured into the stomach. At first this juice produces no apparent change upon the food, but soon the outer layer slowly softens, until, losing its texture, it is completely dissolved. The muscles then contract upon this softened layer and carry it toward the pylorus. Then, in like manner, the next layer of food is dissolved in the same way, and removed to the same place.

Thus the process goes on until all the food is converted into chyme.

In its action upon the food the gastric juice is aided by the muscles of the stomach, which, by their alternate contraction and relaxation, compress it in various ways, and give it a sort of churning motion. As soon as the chyme, by its gradual accumulation in the right portion of the stomach, amounts to two or three ounces, a series of actions takes place, of which the following is the result.

The small end of the stomach, contracting behind the chyme, forces it toward the pylorus, which relaxes and suffers it to pass into the small intestine.

The pylorus then contracts, and the small end of the stomach relaxes, and they remain so until the same quantity of chyme again accumulates, when the same motions are renewed with the same result. Thus the process goes on until all the chyme resulting from the dissolution of the food is driven into the small intestine. I have said that our food, by the action of the gastric juice, is converted into a different substance with different properties.

This, however, is true only of the solid portion of our food. The water which we drink, whether it is pure or whether it has other substances dissolved in it, is not acted upon by the gastric juice, but is absorbed, unchanged, into the veins of the stomach, where it is mingled with the blood. Until this absorption takes place, the gastric juice will not be secreted, and, of course, the food will not be assimilated. Now, the water will not be drawn into the veins unless the body needs it, and this need will be indicated by the sensation of thirst. If, then, we drink when we are not thirsty, the water will remain some time in the stomach and delay the assimilation of our food. This is one reason for drinking nothing but pure water, for ordinarily we will not drink water when we are not thirsty, but if something be added to the water to make it agreeable, we will drink for the mere pleasure of drinking. It is also a reason for taking food in the solid rather than in the liquid form, for in the latter case we will be liable to take more water than the body requires. Thus much of the liquid food. Let us turn now to the solid food.

We have seen that the assimilation of the solid food is accomplished by the gastric juice. Of course, then,

the greater the quantity and the purer the quality of the gastric juice, the more food will it be able to assimilate.

We have also seen that this juice is secreted from the blood, and hence its quantity and purity will be affected by the state of the blood. But the condition of the blood, as we have noticed before, is indicated by the condition of the mucus and saliva of the mouth. If, then, the mucus and the saliva be impure, the gastric juice will be deficient and depraved, and hence will be able to assimilate imperfectly only little food.

It hence follows, as a natural consequence, that when the secretions within the mouth have a bad color, and unpleasant taste, we should not eat.

Should we neglect this warning, our food will be mixed with impure saliva, and hence will enter the stomach in an unfit condition. It will then be acted on by a small quantity of bad gastric juice, which will assimilate imperfectly only a portion of the food.

And what becomes of the remainder?

It acts in the stomach as it would do in any other damp warm place.

It putrifies and sends forth poisonous gases, which, enlarging, press against the fibres of the stomach, and injure in various ways. The consequence is, that either there is a backward action of the muscles of the stomach and gullet, and the foul mass is vomited forth, or else it is forced into the small intestine, causing the bowel complaint. This shows the folly of trying to gain strength in sickness, by eating food, and proves the benefit of fasting, for it is not, no, it cannot be proper, to burden the system with the assimilation of food when it is over-

tasked in endeavoring to purify the blood. Even in health we should be careful not to eat more than the body requires; for, if we do, then either the food will be imperfectly assimilated from the want of sufficient gastric juice, or else the stomach will receive more than its share of blood and nervous energy, and thus rob the other organs of their share, or else only a part of the food will be assimilated, and the rest will breed disease.

But how can we know when we have eaten exactly enough? Simply by eating only when we have an appetite, and by ceasing when we have satisfied that appetite.

This can easily be observed if we will only eat simple food: but if we season our dishes highly to pamper the taste, we will eat for the mere pleasure of eating. Thus simple food as well as pure water is the best nutriment for man. This fact is proved by experience, as well as prescribed by theory; but, though all acknowledge it, few will practice it, for most men choose present pleasure even at the expense of future pain.

Having said thus much of the stomach, we will now proceed with the process of nutrition.

The chyme, as we have noticed, is poured from the stomach into the small intestine. The small intestine is a narrow tube of great length, being about four times as long as the body. It is folded many times in various ways and ends, as we have already said, in the lower part of the right side of the abdomen, where it communicates through a valve with the large intestine. The small intestine has two layers of muscles, the one running lengthwise and the other around it, which by

contracting, make it both shorter and narrower. Around these muscles, as well as on the outside of every internal of the body, there is a thin shining membrane.

This is everywhere pierced by millions of little tubes communicating each with a little bag. From every one of these exudes a thin, watery fluid, called serum, which lubricates the outer surfaces of all the internal organs, and thus enables them to slip over each other without injury. The serous membrane, which surrounds the small intestine, extends behind it like a riband.

This flat appendage, with its two layers of serous membrane, is called the mesentery. Between the layers of mesentery, there are nerves, and arteries, and veins, and other vessels, passing back and forth.

The mesentery is fastened to the spine, and thus keeps the small intestine in its place, and yet allows it to move freely in all directions.

The small intestine, like the stomach, has an internal lining, which is arranged in numerous folds, so as greatly to enlarge its surface. Millions of small glands pierce this coat, and pour out mucus to lubricate its surface. Millions of little fibrils also project from it, and secrete from the blood a fluid something like the gastric juice. In the upper part of the small intestine a tube leads into it on the left from the pancreas.

It is in this same part of the small intestine that the gall tube leads into it from the liver on the right.

The pancreas is placed in the upper part of the abdomen behind the lower part of the stomach. It is a tube with branching tubes, and branches of branches, each ending in a little bag.

Every one of these tubes and bags is brought into contact with branching nerves and arteries. From the blood of the arteries they secrete a fluid called the pancreatic juice, and pour it into the small intestine.

The pancreatic juice looks like saliva, though it has very different properties, and aids the intestinal juice in changing the nature of chyme.

Let us now proceed with the process of nutrition. The chyme received from the stomach, being acted on by the intestinal juice and the pancreatic juice, is converted into a fluid that looks somewhat like milk, though it possesses very different properties. This white fluid is called chyle. In assimilating chyme to chyle, the intestinal and pancreatic juices are aided by the alternate contraction and relaxation of the muscles of the small intestine, which give it a sort of churning motion.

It is a matter of dispute among physiologists whether or not the gall and the bile aid the other juices in assimilating chyme to chyle.

Those who maintain that it does, urge in its favor an experiment several times repeated in France, in Germany, and in England.

The abdomen of an animal was cut open, and its gall tube was tied, and then it was fed. Some time after it was examined, and no chyle was found in the small intestine, nor in the vessels that branch from the small intestine, and hence it was concluded that the gall and the bile are essential to the assimilation of chyme. Now this does not seem to be a fair conclusion, for the wound inflicted in cutting the animal open, and the fever resulting from it, would of themselves have prevented the assimilation of chyme, even if the gall tube had not

been tied. If the experimenters had cut open two animals instead of one, and had tied the gall tube of one, and not of the other, and after feeding, had found chyle in the one whose gall tube was not tied, and found no chyle in the other, then the experiment would have been conclusive.

But this was not done, and hence the experiment affords no proof that the gall and the bile are necessary in converting chyme into chyle. But it may be asked, Why are these fluids poured into the upper part of the small intestine if they afford no aid in assimilation? To this it may be answered, that they dissolve fatty matters and thus prepare them for assimilation, and also delay the putrefaction of waste matters that pass through the small intestine.

These actions are very different from assimilation, and yet they are essential to bodily health.

Having examined the arguments of one side, I will now turn to those of the other. The fact that the gall and the bile are secreted from the dark red blood, while the gastric, the intestinal, and the pancreatic juices are all secreted from the bright scarlet blood, is urged as a proof that the former are not made for the assimilation of chyme, but for the purification of the blood, and hence, that though they may enter the small intestine partly to dissolve fatty matters and delay putrefaction, it is mainly for the purpose of purifying the blood.

Such is the first proof.

And now for the second. The bile and the gall in a healthy state of the system are never found in the stomach. Whenever, by the backward action of the small intestine, and the relaxation of the pylorus, the gall and

the bile are forced into the stomach, the stomach recognizes them as enemies and immediately proceeds to expel them.

It either drives them back to the place whence they came, or else, aided by the gullet, it vomits them forth. Now this is not the case with either the intestinal juice, the pancreatic juice, or the chyle.

The stomach can bear their presence, and makes no violent effort to remove them.

Now why is the stomach content with these and not with those?

Is it not because it is endowed by its Creator with the power of discriminating between what is good for the body and what is injurious to it?

If so, then have we not sufficient proof that the gall and the bile are noxious fluids, instead of assimilating juices, and that they are secreted from the blood for the purpose of purifying it, and of being removed from the body.

And here let me remark, that the presence of an emetic in the stomach causes a backward action of its muscles, which is often propagated to the small intestine. Thus the gall and the bile are forced into the stomach, which, aided by the gullet, vomits them forth together with the emetic.

When this happens, the patient naturally supposes that the gall and the bile were in the stomach before the emetic was swallowed. If he acts on this supposition, these noxious fluids will continue to be given off as often as the emetic is administered, until death ensues, as has sometimes been the case.

Let us return now to the process of nutrition.

We have said that the assimilation of chyme is accomplished by the intestinal and pancreatic juices. These act at first upon the chyme in the upper part of the small intestine, and convert a portion of it into chyle.

This fluid is at once absorbed by the coats of the small intestine.

What now becomes of the undissolved chyme? The muscles of the small intestine above the chyme contract upon it and force it down a little.

Then additional intestinal juice is secreted, another portion of the chyme is converted into chyle, which is absorbed by the small intestine. Thus the continually diminishing chyme is continually being forced down the whole length of the small intestine, until the balance of it approaches the large intestine.

Here, instead of chyme, we have the portion of it that cannot be dissolved.

This consists of the bran of wheat and corn, the skin of seeds, and fruit, and other indigestible matters.

These pass through a valve into the large intestine, where they are mingled with the impurities that have been secreted from the blood.

Thus we see that there is a provision in the body for the purpose of separating the nutritious portions of our food from the innutritious.

Hence we find in most articles of food a large quantity of waste material.

If this were not the case we would soon become diseased. I will now give additional proof of the fact, that it is beneficial to health to have innutritious matters mingled with our food. In order that the muscles

of the stomach may churn the food to the greatest advantage, it is necessary for them to be filled out with a certain bulk. If in order to obtain this bulk we eat a large quantity of pure nutriment, the gastric juice will not be able to assimilate all of it, and hence there will be disease.

But if we eat food that has much waste material mingled with it, we can take little nutriment, and yet have sufficient bulk. In addition to this, the innutritious materials will cause the food to be spread over large space, and hence the gastric juice can act on it to a better advantage.

In accordance with these views, we find that, in summer time, when we do not need as much nutriment as in winter, we have fruits, and vegetables, which usually have great bulk combined with little nutriment.

This is the proper place also to remark, that ever since the time when machinery was so perfected as to separate the bran from the wheat, constipation has been a general complaint, while before that time it was scarcely known. Such is the penalty we are obliged to pay for disregarding the laws of health.

We will now proceed with the process of nutrition. In describing the assimilation of chyme to chyle, we have said that the chyle, as soon as it was formed, was absorbed by the coats of the small intestine.

Let us now look at the vessels which receive the chyle and pass it onward.

In the inner coat of the small intestine there is a network of small vessels. From this network small tubes arise that unite into larger tubes, and these into still larger. The last pierce to the outside of the

mucous coat, and pass some distance between it and the muscular coat. At length they pierce the muscular coat, and run between it and the outer coat of the small intestine, until they reach the mesentery. The mesentery, as we have already stated, is simply a flattened continuation of the serous membrane of the small intestine. The tubes then pass between the layers of the mesentery, when they unite and form a network of vessels. From this network arises tubes that branch, and enter a set of glands, where they form a network, and bend hither and thither, and are interwoven with nerves and blood vessels. The tubes, after going out of these glands, again unite into larger tubes the same in number as before. These tubes again branch and enter another set of similar glands, where they are interwoven with nerves and blood vessels, and after leaving these glands they again unite and form larger tubes, which leads to a pouch in the upper part of the abdomen. From this pouch, called the receptacle of the chyle, there is a tube that rises through the chest, and communicates with a vein at the root of the neck.

The vessels that convey the chyle from the small intestine to the receptacle of the chyle, are called lacteal vessels, and the glands through which they pass are called lacteal glands. They are so called from lac, the Latin term for milk, because the chyle resembles milk. When the chyle is absorbed by the mucous coat of the small intestine, it enters the lacteal vessels along which it goes, and passes through the lacteal glands. Within these glands the chyle is brought into intimate contact with the blood, which changes its nature by removing some of its elements, adding others to it, and

altering the arrangement of those which it retains.

Within these glands, also, those little circular flat bodies are formed which give the scarlet color to the blood. They do not, however, obtain this color until they have entered the lungs. These bodies are so small that it takes five thousand of them laid side by side to extend an inch, and yet each of them contains another cell which has a nucleus within it.

Thus we see that the chyle is assimilated by the blood within these lacteal glands, and after going out of them is a different fluid from what it was before.

Then the assimilated chyle goes to its receptacle, whence it rises through the chest and enters the veins. Thence the chyle, together with the lymph, and the dark blood, is sent to the lungs, where it undergoes another assimilation.

The air of the lungs, by its action upon the white chyle, the clear lymph, and the red blood, giving to them electricity, and oxygen, and removing from them carbonic-acid gas and noxious vapor, changes their nature, and forms them all into a uniform fluid, the scarlet blood.

And now the scarlet blood itself must undergo an assimilation. This is done when it enters the tissues of the body, and destroys a part of them. Then out of the scarlet blood, new flesh is formed to counterbalance the loss of the old, and this is the final assimilation.

Having thus traced the changes which the food undergoes in the body, let me remark, in the first place, that since the juices which assimilate the chyme are secreted from the blood, if the blood be impure we will have depraved or deficient chyle.

In the second place I will observe, that since our

flesh is formed from the blood, if the blood be impure we will have deficient or unhealthy flesh.

Thus close is the connection between a healthy body and pure blood.

In the third place let me remark upon the change which the chyle undergoes in passing through the lungs. It is not until it is exposed to the action of the air that it loses its white color, and assumes a scarlet hue. And without scarlet blood there can be no healthy blood, and this change of color will be only partial, unless we breathe pure air. All the other assimilations of our food might be perfect, and still they would be counterbalanced if we should inhale a foul atmosphere. How then is it that so much importance is attached to the quality of our food, and so little to the purity of the air?

We eat ordinarily only three times a day, and not at all in the night, and can go without eating for several days. Thus it is with our food. On the other hand we breathe day and night, eighteen times a minute, and if we stop it for three minutes we will die.

Would it not then be supposed that we would be more careful to breathe pure air than to eat good food? And yet we devote most of our attention to the former, and scarcely any to the latter, and this, too, when in order to obtain the required nutriment, we must exercise muscles and brain day after day, and year after year; whereas, there is an ocean of pure air covering the whole globe to the height of fifty miles above our heads, that only needs to be led into our apartments while the foul air is forced out.

Since, in the former part of this lecture, I pointed

out one way in which an ordinary apartment could be ventilated, and since further discussion would detain us too long, I shall say no more on the subject. I shall be satisfied if I have given my hearers even a faint idea of its overwhelming importance.

I think, my hearers, that even from the imperfect description of the human body which I have given, you may obtain some conception of the infinite wisdom employed in its construction. It is a marvellous instance of Almighty power, and, in union with the soul, is the crowning work of creation.

We, who are subject to sorrow and disease, cannot conceive of the glorious beauty that enrobed the forms of our first parents as they walked in happiness and purity in the garden of Eden, when angels were their guests, and God was their friend.

Though they had motions and sensations like our own, though like us they assimilated food and breathed the air, yet their bodies were gifted with the power of resisting forever the inroads of disease and of death.

And thus would it have continued had they not disobeyed the command of their Creator and eaten of the fruit of the tree of knowledge. This fruit was endowed by the Almighty with the power of altering the constitution of the body, so that it would gradually yield to the elements of decay. If, after eating of this baleful fruit, they had partaken of the fruit of the tree of life, then they would have obtained an antidote, and regained their immortality. But this was not to be, for the Almighty drove them out of the garden of Eden, and placed at its entrance cherubim, and a flaming sword which turned in every direction, to guard the way of the

tree of life. Over the scenes of sin, and pain, and sorrow, that then ensued, angels would weep if they could weep. It touched the compassion of God. No sooner had He driven the unhappy pair from the gates of Paradise, than He turned their despairing gaze to Him who should bruise the serpent's head, the promised seed of the woman.

And who was this? None other than his own eternal Son, who was to assume our nature in conjunction with his divine nature. In the course of revolving years, after a guilty race had all been drowned by the deluge, and none, save eight righteous, remained to repeople the globe; after clearer prophecies had been promulgated, and a preparatory covenant had been instituted, the Virgin Mary was indicated as the destined woman whose seed should bruise the serpent's head.

It was through the overshadowing influence of the Holy Ghost upon her, that she conceived an infant who was both God and man. Then it was that to his everlasting, Almighty, all-wise, boundless divinity, Jesus Christ joined his new-conceived mortal, feeble, ignorant, limited humanity. Such was the mysterious Being who was born of a woman, and was laid in a manger. Well, then, might the angels, with songs of holy joy, announce it to the shepherds of Bethlehem, and well might a meteor, gleaming in the sky, guide the wise men of the East to the destined king of the Jews.

Although our Saviour, being born of a woman, possessed a soul that was subject to sorrow, and a body exposed to disease and death, yet, through the influence of the Holy Ghost, he was not conceived in iniquity. Hence it was, that though he suffered and died, it was

for the sins of others, and not for his own. It was to atone for our sins that the Son of God underwent his lowly birth, and suffering life, and painful death.

Does it not, my hearers, indicate the inconceivable value of the human body, when even the Eternal Son of God did not disdain to unite it to his divine nature? Would God have become man if the body is so worthless as many deem it? Surely not, and therefore the health of the body should be the subject of our thoughts as well as the health of the soul. And the failure of the one will subject us to temptation as well as the failure of the other. It was when our Saviour's body had been reduced by a superhuman fast of forty days, that the devil urged him at first to prove his divinity by converting stones into bread, and afterwards to cast himself from the wing of the temple that the angels might sustain him, and lastly, to worship the tempter that he might possess the glorious kingdoms beheld from the mountain top. Such were the temptations, but Jesus overcame them all, and bade his defeated adversary to worship the Lord his God, while angels came and ministered unto the conqueror.

It was while he was in the body that Jesus endured that sore agony in the garden of Gethsemane, when he did sweat, as it were, great drops of blood, and prayed, "Father, if thou be willing, remove this cup from me: nevertheless, not my will, but thine be done." And the Father listened to his prayer, and an angel came down from Heaven to strengthen him.

It was his body that was betrayed by one of his own disciples, seized by his enemies, condemned in the judgment hall, was beaten with rods, crowned with thorns,

and spit upon. It was the agony of his body hanging upon the accursed cross, beneath a frowning heaven, above a mocking world, that made him utter that bitter cry, "My God, my God, why hast thou forsaken me."

It was at the parting of the soul from his body, that the earth did quake and the rocks rent, and the veil of the temple parted in twain, and many graves of holy men, opening wide, released their victims freed from death, and the Roman centurion, listening to the voice of conscious nature, cried aloud, "Truly, this was the Son of God."

It was his body, pale, distorted, and bloody, that was lowered from the cross and borne to the garden, and laid in the silent gloom of the new-made sepulchre, hewn out of the solid rock. It was his lifeless body that was guarded by Roman soldiers until the dawn of the third day, when an angel came down from heaven and rolled away the stone from the door of the sepulchre, and sat upon it, and glared, like lightning, upon the warriors, who became as dead men.

It was his body which his soul, returning from Paradise, rejoined in the grave. And then his wounds were healed, and his blood circulated, and his lungs breathed, and color came to his cheek, and strength to his limbs, and he arose from the grave forever triumphant over death.

The body of our Saviour, after his resurrection, was the same that he possessed before his death, though it was freed from subjection to disease and decay.

This is proved by the fact that his raised body retained traces of the wounds he had received during the crucifixion. It was only after feeling the prints of the

nails in the Redeemer's hands, and the mark of the spear in his side, that the doubting Thomas believed in the reality of his resurrection, and exclaimed, "My Lord and my God."

It was his body that from the top of Mount Olivet rose to heaven, while half a thousand disciples gazed upon his lessening form until an intervening cloud hid him from their sight. It was his body that continued to rise, passing world after world of countless creation, until he entered the gates of heaven, amid the hallelujahs of archangels, and of seraphim, and cherubim. It was his body that sat upon the right hand of the Father, where he received the adoration of angels, and wielded the sovereignty of the universe.

It is his body that still continues in heaven pleading for his people, presenting their prayers to the Father, and sending down upon them the Holy Spirit. It is in his body, once humiliated, now glorified, that he will come down from heaven and redeem his people from their enemies, and restore to them their beloved city, and reign over them forever. Such is the exaltation imparted to the human body by Jesus Christ.

I would now remark, my hearers, that our Saviour's resurrection is a pledge of our resurrection.

As sure as Jesus rose from the sepulchre with the same body which was crucified, so sure will we rise from our graves with the same bodies which shall part from our souls. This, many will declare to be impossible, because our bodies will be decomposed, and their elements will rise in the air, and fly on the wings of the wind, and sparkle in the foam of the ocean, and form a part of the solid globe, and enter the bodies of plants,

and of animals, and of successive generations of men.

They deem it impossible, even for God, to trace the countless atoms of millions of men in their intricate wanderings, and to restore them to the same bodies from which they came.

But who shall dare to limit the power and the wisdom of God?

Not until we have sounded to its depths the skill displayed in the construction of the human body, should we presume to measure the power of Him who holdeth creation in the hollow of his hand.

It is too much the custom of the present day for man to boast of the attainments of science, and to measure his puny arm against the arm of Omnipotence.

But what is the amount of knowledge gathered from a thousand sources in all departments in science as compared with what is unknown? It is but as a few drops of water out of the boundless ocean. Such is my answer to the first objection. But there is another, and a stronger objection.

It is urged that the dead bodies of one generation have been formed in part of the dead bodies of preceding generations, and that the particles which are thus common to several, cannot be restored to all, and that, consequently, our bodies after the resurrection will not be the same as before death. In reply to this I remark, that it proceeds on the supposition that the identity of the body cannot be preserved unless all its particles are restored to it; but this cannot be allowed. The body during life is continually changing; every moment it is losing old flesh and receiving new, and yet, during all this time, it is the same body. In order,

therefore, that the body, after the resurrection, be the same as it was during life, it is only necessary for the elements of the old body, which are not common to other bodies, to be gathered together as a nucleus and incorporated with new matter.

This was not necessary in the case of our Saviour, for he was raised from the dead before his body had yielded to corruption; but such must have been the mode in which those saints were restored to life, who, after the resurrection of our Redeemer, came out of their graves and went into the holy city, and appeared unto many.

Their bodies must have been dissolved, and therefore the earthy particles remaining in their graves must have been incorporated with new matter when they were rebuilded into immortal bodies.

As it was with them, so shall it be with us on that day when the archangel's trump shall sound, and call us forth to life and immortality.

Having thus shown the identity of the body in this world and the next, I will next remark that they closely resemble each other. Of this our Saviour himself furnishes a remarkable proof. When our Saviour appeared for the first time before his assembled disciples, after his resurrection, and said, "Peace be unto you," they were affrighted, supposing him to be a spirit. It was not until he had said unto them, "Behold my hands and my feet, that it is I myself: handle me and see; for a spirit hath not flesh and bones as ye see me have," that they were reassured and believed him to be the risen Lord. It is further stated by St. Luke that he showed them his hands and his feet, and ate a piece of a boiled fish

and of an honeycomb. Thus we see that our Saviour's body possessed traces of the wounds which it had received during the crucifixion, and that it assimilated food just as it did before his death.

Thus our Saviour in his glorified humanity resembled Adam and Eve in the garden of Eden. And such, we have every reason to believe, will be our condition after the resurrection.

With these glimpses of a glorious theme I must close.

With you I have looked into the mysteries of the body, have glanced into the garden of Eden, have witnessed the chief events of our Saviour's life, have seen him die upon the cross, rise from the grave, ascend to heaven, and sit upon the throne.

We have also looked forward to the time when he shall come down to redeem his people. And oh! may it be our lot then to meet his approval, and share with him those joys which "eye hath not seen, ear hath not heard, neither hath it entered the heart of man to conceive."

A LECTURE

ON

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